UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 11, 2014

Mr. Ernest J. Kapopoulos, Jr.
Vice President
Shearon Harris Nuclear Power Plant
Duke Energy Progress, Inc.
5413 Shearon Harris Road
New Hill, NC 27562-9300

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 – RELIEF REQUEST I3R-13 FOR REACTOR VESSEL CLOSURE HEAD PENETRATION NOZZLE NO. 37 REPAIR, INSERVICE INSPECTION PROGRAM – THIRD 10-YEAR INTERVAL (TAC NO. MF3104)

Dear Mr. Kapopoulos:

By letter dated November 22, 2013, to the U.S. Nuclear Regulatory Commission (NRC), as supplemented by letter dated November 25, 2013, Duke Energy Progress, Inc. (the licensee) submitted Relief Request (RR) I3R-13 for Shearon Harris Nuclear Power Plant, Unit 1. The licensee requested to use alternatives for certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, related to the repair of degraded reactor vessel closure head (RVCH) penetration nozzle No. 37.

During the November 18, 2013, refueling outage, the licensee detected a flaw indication during the inservice inspection (ISI) examination of the RVCH nozzle penetration tube No. 37, and repaired the degraded nozzles using the alternatives specified in this request. RR I3R-13 was requested for the third 10-year ISI interval, which commenced on May 2, 2007, and will end on May 1, 2017.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i), the licensee proposed alternatives to the requirements of the ASME Code, Section XI, Article IWA-4000, "Repair/Replacement Activities," on the basis that the alternatives provide an acceptable level of quality and safety.

The NRC staff reviewed the subject request and concludes, as set forth in the enclosed safety evaluation (SE) that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(i). In addition, on November 26, 2013, the NRC staff verbally authorized the use of RR I3R-13. The script for the verbal authorization was issued on November 27, 2013 (Agencywide Documents Access and Management System Accession No. ML13330B639). The enclosed SE documents the NRC staff's detailed technical basis for the verbal authorization.

If you have any questions, please contact the Project Manager, Andrew Hon at 301-415-8480.

Sincerely,

for

Jessie F. Quichocho, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosure:
Safety Evaluation

cc w/enclosure: Distribution via ListServ

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST I3R-13: REACTOR VESSEL CLOSURE HEAD PENETRATION NOZZLE NO. 37 REPAIR

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

1.0 INTRODUCTION

By letter dated November 22, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13329A354), as supplemented by letter dated November 25, 2013 (ADAMS Accession No. ML13330A996), Duke Energy Progress, Inc. (the licensee) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, related to the repair of degraded reactor vessel closure head (RVCH) penetration nozzle No. 37 at Shearon Harris Nuclear Power Plant, Unit 1 (Harris). The licensee submitted for U. S. Nuclear Regulatory Commission (NRC) review and approval this relief request (RR) I3R-13 for the third 10-year Inservice Inspection (ISI) interval, which commenced on May 2, 2007, and will end on May 1, 2017.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i), the licensee proposed alternatives to the requirements of various articles in the ASME Code, Sections III and XI, and ASME Code Cases N-638-1 and N-729-1 on the basis that the alternatives in RR I3R-13 provide an acceptable level of quality and safety.

The NRC staff reviewed the licensee's submittals and determined that the proposed alternatives are technically justified and provide an acceptable level of quality and safety. On November 26, 2013 (ADAMS Accession No. ML13330B639), the NRC staff verbally authorized the use of RR I3R-13 for the third 10-year ISI interval. The NRC staff's detailed technical basis for the verbal authorization is documented below.

In addition, by letters dated May 3, 2012, May 18, 2012, and May 22, 2013 (ADAMS Accession Nos. ML12131A663, ML12139A407, and ML13143A167, respectively), the licensee submitted RRs I3R-09 and I3R-11 for the similar repair of RVCH penetration nozzle Nos. 5, 17, 38, 63, and 49. By letters dated October 2, 2012, and September 13, 2013 (ADAMS Accession Nos. ML12270A258 and ML13238A154, respectively), the NRC staff previously approved RR I3R-09 and 13R-11.

2.0 REGULATORY EVALUATION

Section 50.55a(g)(4) of 10 CFR specifies that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, incorporated by reference in 10 CFR 50.55a(b), 12-months prior to the start of the 120-month interval, subject to the conditions listed therein.

Pursuant to 10 CFR 50.55a(g)(6)(ii), the Commission may require the licensee to follow an augmented ISI program for systems and components for which the Commission deems that added assurance of structural reliability is necessary.

Section 50.55a(g)(6)(ii)(D) of 10 CFR, *Reactor vessel head inspections,* requires licensees of pressurized water reactors (PWRs) to augment their ISI of the RVCH with ASME Code Case N-729-1, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds, Section XI, Division 1."

Section 50.55a(a)(3) of 10 CFR states that alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the NRC, if the licensee demonstrates (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the Commission to authorize the alternative requested by the licensee.

3.0 RELIEF REQUEST I3R-13

The affected component is ASME Class 1, RVCH penetration nozzle No. 37, which is made of Inconel SB-167, with a nominal outside diameter (OD) of 4 inches.

The code of record for the third 10-year ISI interval is Section XI of the 2001 Edition through 2003 Addenda of the ASME Code. The 1971 Edition through Winter 1971 Addenda of the ASME Code, Section III, is the Construction Code for the RVCH at Harris.

The ASME Code, Section III, NB-5245, requires incremental surface examination of partial penetration welds.

The ASME Code, Section XI, IWA-4221(b) and IWA-4221(c) require the use of the Construction Code.

The ASME Code, Section XI, IWA-4400, provides requirements for welding, brazing, metal removal, and installation related to repair/replacement activities.

The ASME Code, Section XI, IWA-4411, requires welding, brazing, and installation be performed in accordance with the Owner's Requirements and, except as modified below, in accordance with the Construction Code of the item.

The ASME Code, Section XI, IWA-4411(a), states, in part, that "Later editions and addenda of the Construction Code, or a later different Construction Code, either in its entirety or portions thereof, and Code Cases may be used, provided the substitution is as listed in IWA-4221(c)."

The ASME Code, Section XI, IWA-4610(a), requires that thermocouples and recording instruments be used to monitor the process temperatures.

The ASME Code, Section XI, IWA-4611.1(a), requires that defects be removed in accordance with IWA-4422.1 and that a defect is considered removed when it has been reduced to an acceptable size.

The ASME Code, Section XI, IWA-3300, requires flaw characterization.

The ASME Code, Section XI, IWB-3420, requires that flaws be characterized with dimensions, which shall be used in conjunction with the acceptance standards of IWB-3500.

The ASME Code, Section XI, IWB-3132.3, permits unacceptable flaws to remain in service provided that they are accepted by analysis per IWB-3600 and the flaws are subsequently reexamined.

ASME Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temperbead Technique, Section XI, Division 1," provides requirements for automatic or machine gas tungsten arc welding of ASME Code Class 1 components without the use of pre-heat or post-weld heat treatment.

ASME Code Case N-729-1, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds," as conditioned in 10 CFR 50.55a(g)(6)(ii)(D), requires RVCH penetration nozzles be examined.

The licensee detected a flaw indication on RVCH penetration nozzle No. 37 during an ISI program ultrasonic examination of the RVCH penetration nozzles. The flaw is in the tube OD surface extending inward toward the tube inside diameter (ID) and is axially oriented at the lower toe side of the J-groove weld. Figure 10 of RR I3R-13 (ADAMS Accession No. ML13329A354) shows the location of the axial indication and Figure 11 shows the relative location of the nozzle on the RVCH. Table 1 of RR I3R-13 provides flaw sizing and characterization.

The licensee stated that it is not feasible to repair the subject nozzle in accordance with the requirements of the original Construction Code because the post-weld heat treatment required by the Construction Code may damage the RVCH material properties and dimensions. As an alternative to the requirements of the Construction Code, the licensee proposed to repair nozzle

No. 37 using the Inside Diameter Temper Bead (IDTB) welding method to restore the pressure boundary of the degraded nozzle. The IDTB welding method is performed with a remotely operated weld tool, using the machine gas tungsten arc welding process and the ambient temperature temperbead method with 50 degrees Fahrenheit minimum preheat temperature and no post-weld heat treatment.

The licensee proposed to repair and inspect RVCH penetration nozzle No. 37 in accordance with requirements of the 2001 Edition through 2003 Addenda of the ASME Code, Section XI, ASME Code Case N-638-1, and ASME Code Case N-729-1 with certain deviations as discussed below.

The licensee requested relief from requirements of the ASME Code, Section XI, IWA-4610(a), and ASME Code Case N-638-1, paragraph 3.0(d), specifically related to use of the thermocouples and recording instruments to monitor welding process temperatures because the direct interpass temperature measurement is impractical to perform during welding operations from inside RVCH nozzle penetration bore. As an alternative, the licensee proposed that the maximum interpass temperature be determined by heat-flow calculations.

The licensee requested relief from requirements of ASME Code Case N-638-1, paragraph 4.0(b), specifically related to the surface and volumetric examinations of the final weld surface and the band around the area defined in paragraph 1.0(d) of the code case. The licensee requested relief because the required area defined in paragraph 1.0(d) of the code case cannot be examined due to the physical configuration of the partial penetration weld. As an alternative, the licensee proposed that the new weld and immediate surrounding area within the bore identified in Figure 3 of RR I3R-13 (ADAMS Accession No. ML13329A354) receives liquid penetrant testing (PT) and ultrasonic testing (UT) examinations.

The licensee requested relief from the incremental surface examination of partial penetration welds of the ASME Code, Section III, NB-5245, of the 2001 Edition through 2003 Addenda because it cannot perform incremental surface examinations due to the welding layer deposition sequence (i.e., each layer is deposited parallel to the penetration centerline). As an alternative, the licensee proposed to volumetrically examine the new weld, with the exception of the taper transition, and to examine the surface of the completed weld by PT.

The licensee requested relief from requirements of ASME Code Case N-638-1, paragraph 4.0(b), specifically related to commencing the 48-hour hold period when the weld reaches ambient temperature. As an alternative, the licensee proposed that the 48-hour hold period will commence upon completion of the third weld layer. The licensee also requested relief from the above requirements to permit anomalies at the triple point area to remain in service. The licensee stated that an artifact of ambient temperature temperbead welding is an anomaly in the weld at the triple point. The triple point is the point in the repair weld where the low alloy steel RVCH base metal, the Alloy 600 nozzle, and the Alloy 52M weld intersect. As an alternative, the licensee performed a flaw evaluation to accept the triple point anomaly.

The licensee requested relief from the flaw characterization requirements of the ASME Code, Section XI, IWB-3420 and the subsequent examination requirement of IWB-3132.3 for the remnant J-groove weld because it is impractical to characterize and examine the flaw geometry

due to nozzle penetration configuration. As an alternative, the licensee evaluated a worst-case flaw in the remnant J-groove weld in accordance with IWB-3132.3.

The licensee stated that ASME Code Case N-729-1, Table 1, Item 4.20, permits either surface or volumetric examination of the RVCH penetration nozzles. Figure 9 of RR I3R-13 (ADAMS Accession No. ML13329A354) will be used to establish the area for the preservice and inservice examinations following the nozzle repair.

The licensee analyzed general corrosion of a small portion of low alloy steel in the RVCH nozzle penetration bore that will be exposed to primary coolant as a result of the nozzle repair. The licensee stated that the corrosion of the exposed base metal has negligible impact on the RVCH and is acceptable for 40 years from the time the repair is completed.

The licensee stated that the provisions of this relief are applicable to the third 10-year ISI interval for Harris, which commenced on May 2, 2007, and will end on May 1, 2017. The license further stated that the proposed repairs shall remain in place for the design life of the repair, until another alternative is approved by the NRC, or until the RVCH is replaced.

4.0 NRC STAFF EVALUATION

As discussed above, when repairing RVCH penetration nozzle No. 37, the licensee will deviate from certain requirements of the 2001 Edition through 2003 Addenda of the ASME Code, Section XI, ASME Code Case N-638-1, and ASME Code Case N-729-1. For each deviation, the licensee proposed an alternative as discussed above. Relief Requests I3R-09, RR I3R-11, and RR I3R-13 are similar and the NRC staff has approved RR I3R-09 and RR I3R-11. The NRC staff's technical basis to accept the proposed alternatives in RR I3R-13 will be based on the same technical basis that the NRC staff used to accept RR I3R-09 and I3R-11.

The ASME Code, Section III, Subarticle NB-4600, "Heat Treatment," requires pre-heat and post-weld heat treatment when performing welding. ASME Code Case N-638-1 does not require pre-heat or post-weld heat treatment when using the ambient temperature temperbead welding technique. However, the NRC has approved the licensee to use ASME Code Case N-638-1 for the third 10-year ISI program in the safety evaluation for RR 13R-09.

The proposed IDTB welding method is the same as for RR 13R-09. The repair procedure in RR 13R-13 is the same as RR 13R-09.

The licensee stated that its vendor, AREVA, in support of 128 similar repairs, has qualified the IDTB welding technique in repairing RVCH nozzles using mockups since 2001. During these repair evolutions, the site crew performs training on mockups for each of their respective specialties (i.e., machinists train on machining mockups, welders train on welding mockups, and nondestructive examination (NDE) personnel train on NDE mockups).

The NDE mockup contains a series of electrical-discharge machining notches at the triple point to simulate the triple point anomaly at various depths into the nozzle wall and cracking at the new weld to low alloy steel interface. The mockup also contains flat bottom holes drilled from the mockup outer diameter so that the hole is normal to the surface to simulate fabrication defects such as under bead cracking, lack of bond, and lack of fusion. The NRC staff finds that

the use of the machining, welding and NDE mockups will aid in assuring quality fabrication and examinations of the repair.

ASME Code Case N-638-1, paragraph 3.0(d), requires the maximum interpass temperature for field applications be 350 degrees Fahrenheit regardless of the interpass temperature during qualification. All other requirements of the ASME Code, Section XI, IWA-4000, must be met when using this code case. The ASME Code, Section XI, IWA-4610(a), requires, in part, the use of thermocouples and recording instruments to monitor welding process temperatures.

The licensee stated that heat flow calculations will be used to determine a conservative maximum anticipated interpass temperature to ensure interpass temperature limits are not exceeded. The NRC staff finds that the licensee's heat flow calculations and previous repair experience will provide reasonable assurances that the required interpass temperature limit is not exceed.

ASME Code Case N-638-1, paragraph 4.0(b), requires the final weld surface and the band around the area defined in paragraph 1.0(d) of the code case be examined by surface and ultrasonic methods when the temperature of the completed weld has been at ambient temperature for at least 48 hours. The ASME Code, Section III, NB-4622.11(d)(2), requires surface examination after the completed repair weld has been at ambient temperature for a minimum of 48 hours. The volumetric examination is required, if practical.

The NRC staff finds that the licensee proposed an alternative allowing the 48-hour hold period to commence upon completion of the third temper bead layer is the same as that of RR I3R-11 with the same technical basis. The NRC staff finds that the proposed alternative for the 48-hour hold time acceptable on the same basis as it was accepted in the NRC's safety evaluation for RR I3R-11, because this approach is permitted by ASME Code Case N-638-4 for austenitic materials and the NRC has conditionally approved the use of this code case in NRC Regulatory Guide 1.147, Rev. 16.

In addition, this approach was approved by the NRC for dissimilar metal weld overlays for Harris RR I3R-1 on October 10, 2008 (ADAMS Accession No. ML072760737).

ASME Code Case N-638-1, paragraph 4.0(b) also requires, in part, that surface and volumetric examinations be performed on the final weld and the band around the area defined in paragraph 1.0(d) of the code case. Paragraph 1.0(d) defines the examination area as the area to be welded and a band around the area of at least 1½ times the component thickness or 5 inches, whichever is less. As an alternative, the licensee proposed to perform surface examination using liquid PT on the band around the area to be welded, which includes the exposed surface area of RVCH base metal as presented on Figure 3 of RR I3R-13 (ADAMS Accession No. ML13329A354).

The proposed UT examination will extend from at least 1-inch above the new weld and into the RVCH low alloy steel base metal beneath the new weld, to at least ¼-inch depth. The PT examination area includes the new weld surface and extends upward on the nozzle inside surface to include the area required by ASME Code Case N-729-1, Figure 2, and at least ½-inch below the new weld. The weld taper transition region will be excluded from UT

examination because the UT transducer cannot be positioned to examine the taper transition region. However, the licensee will examine the surface of the taper transition region by PT.

The licensee requested to deviate from the requirement of NB-5245 of the ASME Code, Section III, 2001 Edition through 2003 Addenda, related to incremental surface examinations of partial penetration welds. The licensee stated that it cannot meet this requirement because of the welding layer deposition sequence (i.e., each layer is deposited parallel to the penetration centerline). As an alternative, the licensee proposed to perform surface and UT examinations of the final weld to the extent possible.

The NRC staff finds the licensee's proposed post-weld examination acceptable because the UT examination of new weld and heat affected zone will be performed to the maximum extent possible. Incremental surface examinations are used when volumetric examinations are not practical when the weld is completed. The UT examination is a volumetric examination technique that is capable of detecting flaws throughout the entire depth of the weld. All portions of the weld volume will receive at least a single-direction ultrasonic coverage. In addition, the entire exposed weld taper transition area and the new weld will receive a surface examination by PT. The NRC staff finds that the proposed PT and UT examinations will provide reasonable assurance of structural integrity of the new weld and associated nozzle penetration region.

ASME Code Case N-729-1, Table 1, Item B4.20, permits either surface or volumetric examination of all RVCH penetration nozzles and J-groove welds for ISI. Figure 2 of ASME Code Case N-729-1 specifies the required area and volume of the nozzle and J-groove weld that need to be examined. Figure 9 of RR I3R-13 (ADAMS Accession No. ML13329A354) specifies the examination area or volume for the preservice and ISIs following the repair. The proposed examination area or volume is slightly different from the required examination region in ASME Code Case N-729-1 because the licensee proposed not to examine the remnant J-groove weld.

In accordance with ASME Code Case N-729-1, the licensee will perform the surface or volumetric examination of the new weld including weld taper transition extending up to at least the "a" distance above the top edge of the weld taper on the nozzle inside surface, where "a" includes the surface area and volume required by ASME Code Case N-729-1, Figure 2, which defines the distance "a" as equal to 1.5 inches for nozzle incidence angle less than or equal to 30 degrees to the horizontal plane, or 1 inch for incidence angle greater than 30 degrees to the horizontal plane. The incident angle with respect to the RVCH for nozzle No. 37 is greater than 30 degrees. As such, the licensee will use 1 inch as the "a" distance for examination. The NRC staff finds that the licensee's proposed preservice and inservice examinations acceptable because the extent of examination area and volume specified in Figure 9 of RR I3R-13 (ADAMS Accession No. ML13329A354) satisfies the examinations required by Figure 2 of ASME Code Case N-729-1.

Section 50.55a(g)(6)(ii)(D)(5) of 10 CFR specifies that if flaws attributed to primary water stress corrosion cracking have been identified, whether acceptable or not for continued service under paragraph 3130 or 3140 of ASME Code Case N-729-1, the re-inspection interval must be each refueling outage instead of the re-inspection intervals required by Table 1, Note (8) of ASME Code Case N-729-1. Thus, 10 CFR 50.55a(g)(6)(ii)(D)(5) requires all RVCH nozzles, including

RVCH penetration nozzle No. 37, to be examined every refueling outage. The NRC staff finds that the licensee satisfies the re-inspection frequency requirement of 10 CFR 50.55a(g)(6)(ii)(D)(5) because the licensee follows this Code Case without requesting additional relief from the re-inspection requirements.

As stated above, the licensee requested relief to permit anomalies at the triple point area to remain in service. The NRC staff noted that the triple point is a location in the repaired nozzle where the RVCH low alloy steel, the Alloy 600 nozzle, and the Alloy 52 new attachment weld intersect. An anomaly may be formed in the new attachment weld at the triple point location due to the joint configuration. The 2001 Edition through 2003 Addenda of the ASME Code, Section III, NB-5330(b), prohibits the existence of indications that are characterized as cracks, lack of fusion, or incomplete penetration regardless of length. As an alternative to NB-5330(b), the licensee analyzed a postulated crack-like anomaly at the triple point in accordance with the ASME Code, Section XI, IWB-3600, to justify operating with the anomaly left in service. The licensee modeled this anomaly as a 0.10-inch deep circular crack-like defect extending 360 degrees around the circumference of the nozzle tube at the weld triple point location in the most susceptible material. The results of the licensee's analyses demonstrate that the 0.10-inch weld anomaly is acceptable for a 40-year design life of the nozzle repair.

The NRC staff finds that the licensee has adequately demonstrated by analysis in accordance with the ASME Code, Section XI, IWB-3600, that the triple point weld anomaly is acceptable to remain in service for 40 years without affecting structural integrity of the repaired nozzle.

The licensee requested relief from subsequent reexaminations of the remnant J-groove weld in accordance with the ASME Code, Section XI, IWB-3132.3, on the basis that any "as-left" flaws in the J-groove weld cannot be sized with reasonable confidence by the currently available NDE examination techniques. As an alternative, the licensee analyzed a postulated flaw in the remnant J-groove weld in accordance with the ASME Code, Section XI, IWB-3132.3. The licensee postulated the worst case flaw where the entire J-groove weld is cracked and the crack tip has reached the interface between the butter and the RVCH base metal. The flaw is postulated to propagate into the RVCH base metal by fatigue. The licensee's flaw evaluation result shows that the flaw is acceptable for 30 years of operation.

The NRC staff finds the licensee's flaw evaluation acceptable because the licensee followed the requirements of the ASME Code, Section XI, IWB-3132.3 in determining the "as-left" flaw in the RVCH is acceptable for 30 years.

As part of the nozzle repair, the licensee evaluated the potential for fragments of the J-groove weld falling into the reactor and becoming loose parts. The licensee postulated the radial cracks to occur in the J-groove weld due to the dominance of hoop stresses at this weld location. The licensee determined that the possibility of occurrence of transverse cracks that could intersect the radial cracks is remote because there are no forces that would drive a transverse crack, and the radial cracks would relieve the potential transverse crack driving forces. The licensee stated that it is unlikely that a series of transverse cracks could intersect a series of radial cracks resulting in any fragments becoming dislodged from the remnant J-groove weld. The NRC staff finds that the licensee has adequately demonstrated that the fragments from the remnant of the J-groove weld will not likely fall into the reactor to become loose parts.

As a result of the nozzle repair, the area between the new weld and the J-groove weld of the RVCH nozzle penetration bore is exposed to primary coolant. The licensee determined that general corrosion of the exposed RVCH base metal will most likely occur in the wetted surface of the bore area. The licensee estimated the general corrosion rate to be 0.0036-inch per year in the area, and determined that the RVCH will be acceptable for 40-years following the nozzle repair. By letter dated July 3, 2003 (ADAMS Accession No. ML031840237), the NRC staff approved the use of Westinghouse topical report, WCAP-15987-P, Revision 2, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations." The licensee's corrosion rate is comparable to the corrosion rates discussed in the Westinghouse topical report. The NRC staff finds that the general corrosion of the exposed RVCH base metal is acceptable because the licensee's evaluation considered a reasonable corrosion rate of RVCH base metal.

In summary, the NRC staff determines that the licensee's proposed nozzle repair as presented in RR I3R-13 provides acceptable level of quality and safety because:

a) The licensee has performed necessary flaw analyses to demonstrate the adequacy of the triple point anomaly in the new weld and the worst-case "as-left" flaw in the remnant J-groove weld,
b) The nozzle repair is performed in accordance with the ASME Code, Sections III and XI, and Code Case N-638-1 with deviations. The licensee has satisfactorily addressed deviations with alternatives, and
c) The licensee will examine all RVCH nozzles including the repaired RVCH penetration nozzle No. 37 every refueling outage in accordance with ASME Code Case N-729-1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D). The periodic examinations will provide reasonable assurance of the structural integrity of RVCH nozzle No. 37.

5.0 CONCLUSION

As set forth above, the NRC staff has determined that the alternative method proposed by the licensee in RR I3R-13 will provide an acceptable level of quality and safety for the repair of the degraded RVCH penetration nozzle No. 37. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(i) and is in compliance with the requirements of the ASME Code, Section XI, ASME Code Case N-638-1, ASME Code Case N-729-1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D) for which relief was not requested. Therefore, the NRC staff authorizes the use of RR I3R-13 at Harris for the third 10-year ISI interval, which commenced on May 2, 2007, and will end on May 1, 2017.

All other requirements of the ASME Code, Section XI, and 10 CFR 50.55a(g)(6)(ii)(D) for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Steven Vitto

Date: April 11, 2014

If you have any questions, please contact the Project Manager, Andrew Hon at 301-415-8480.

Sincerely,

/RA by LRegner for/

Jessie F. Quichocho, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosure:
Safety Evaluation

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